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CANMET
Canada Centre for Mineral and Energy Technology
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CORDA

(A Proposed Coal Research and Development Agency)

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CORDA

A Proposed Coal Research and Development Agency

by

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ABSTRACT

There is a national need to provide the necessary advanced technology in coal through Research, Development and Demonstration (R, D & D).

An agency is proposed to accomplish this need by avoiding the constraints in financial, staffing and administrative matters associated with government departments. Such constraints are, of course, necessary in the operation of the Public Service, but are deterrents in expediting solutions to urgent problems. The agency would be known as the Coal Research and Development Agency (CORDA). As an incorporated body, CANMET would have representation on the Board of Directors. A small staff comprising project engineers and administrative support would initially suffice. Technical support staff, if required, could be seconded from CANMET for two-year periods.

The national need for R, D & D in coal would be fulfilled by CORDA as follows:

1. bringing together the expertise, knowledge, experience, needs, views and capabilities of those in industry, governments and universities to:
   (a) jointly plan and/or select research and development projects to effectively solve national energy problems in coal;
   (b) co-ordinate research programs on coal to avoid a duplication and fragmentation of research efforts in Canada;
   (c) advise on matters pertaining to the selection of research and development efforts which should advance to the demonstration stage;
   (d) provide the public sector with an access route to government research facilities.
2. provide a process engineering group of mature, experienced engineers to act as project engineers for coal demonstrations.

CORDA, as an independent body, could be located anywhere in Canada. However, the Department of Energy, Mines and Resources, as the recognized lead agency for the nation's research effort on coal, should play a dominant role in the CORDA concept. For this reason an arrangement is envisaged whereby certain CANMET facilities now located in western Canada could be eventually "wrapped around" CORDA.

A portion of CANMET contract money would be used initially to finance CORDA.

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INTRODUCTION

It is recognized that if Canada is to be fully competitive in world markets its own research effort must be significantly increased.

The Department of Energy, Mines and Resources (EMR), as the lead agency for the nation's research effort in coal, has recommended five strategy elements in coal utilization as coal's contribution towards achieving economic self-sufficiency in energy.

In order to provide the necessary advanced technology in the coal system through research, development and demonstration (R, D & D), an incorporated body is proposed. The agency will be known as Coal Research and Development Agency (CORDA).

CORDA, as an incorporated body, would include a Board of Directors with CANMET representation. A small staff comprising project engineers and administrative support would initially suffice, and, if required, support technical staff could be seconded from CANMET for two-year periods. This would permit the group to "get into business" by contracting fairly large sums of money principally for demonstration purposes.

CORDA will provide greater flexibility in R, D & D by overcoming financial difficulties and constraints associated with Government Departments, by providing mature, experienced engineers to handle demonstrations, by integrating the capabilities of the Government, industry and university communities, by sharing the risks in costly demonstrations, and by providing better access to Government facilities.

This report explores the concept of CORDA.

PREAMBLE

The Need

In the complex energy system, coal in Canada will play a dominant role in the future. Coal production in 1977 was 32 million tons, and by year 2000 it is anticipated that the requirements will be of the order of 200 million tons (i.e. 100 million for thermal power, 40 million for metallurgical coal and 50 million for synthetic liquid fuels, export, substitution for oil, etc.). To achieve this increased production and to ensure that the ultimate value is obtained from it to alleviate the energy shortage, a number of difficult technical problems must be overcome in the coal industry.

The Ministry of State for Science and Technology (MOSST) has reacted to the dire situation of R, D & D in Canada and recently announced measures to strengthen and encourage research and development in Canada. Canada is to aim for a target R, D & D of 1.5 percent of the GDP by 1983. Actual federal funding of R, D & D expressed in deflated dollars per capita of the total labour force in 1978-79 will be less than 1963-64. In the United States a concern has been expressed in the lack of spending of R & D currently at 2.2 percent of GNP. It has been recommended that the level of expenditure be increased to 3 percent in the USA by the end of the 1980's.

Of all the commodities, coal presents the greatest challenge, particularly in utilization, because of its heterogeneous nature and lack of uniformity in-situ, its wide range of technologies and its varying regional demands. Coal properties normally vary in accordance with

geological age and the nature of deposition, and for these reasons coal characteristics are in many cases unique to the source. Canadian coals are particularly noted for their anomalous nature. The Carboniferous coals of Eastern Canada are, in general, submarine in nature, high volatile, high sulphur and relatively low in mineral matter, while the Cretaceous coals of western Canada occurring in the mountains are mainly low-medium volatile, low sulphur and relatively high in mineral matter - subbituminous and lignite coal ranks occur in the Outer Foot Hills and Prairies. The scope of problems associated with mining and beneficiation - common to all forms of coal utilization - is therefore broad. With regard to processing, coal has a wide range of applications which might include complete destruction for recovery in thermal units (combustion), destructive distillation with accruing special products (carbonization) and conversion to liquids and gases (gasification and liquefaction). Conditions such as ample coal reserves, specific ranks and grade, and ideal properties are required for optimum results in the various processes in coal utilization. Canada possesses all ranks of coal but is deficient in many of the other desired conditions, normally required for the various technologies.

Demonstrations, namely industrial-scale projects, are therefore probably required to a greater extent for coal than for most other commodities.

A strong engineering group could be provided by an agency such as CORDA to plan and monitor demonstrations of promising breakthroughs in research and development in order to prove that a particular process is no longer a technical risk for industrial application. CORDA as a focal point, with broad representation on its Board of Directors, would have

tentacles to bring together the knowledge, expertise, experience, needs and views of industry-government-university to contribute to integrated solutions of the national energy problems and to help to eliminate duplication and fragmentation of effort.

The Role of CANMET/EMR

For the past 60 years the coal industry has recognized the leadership which the Department has taken in studies and investigations of coal in Canada. CANMET has reacted to the frequent changes in the patterns in coal requirements. For example, the regional demands for bituminous coal in western Canada suddenly changed in the post World War II years with the loss of traditional outlets for coal in the railway and domestic heating markets to petroleum and natural gas. Many of the producing mines were faced with closure, and the federal government enacted a temporary subsidy to alleviate the situation until new markets were found or alternatively to gradually fade out mine production. CANMET faced this situation by concentrating in two areas to develop new markets for coal, namely combustion (coal for thermal power) and carbonization (coal for coke in the steel industry). The turn-around in the coal industry was phenomenal. The potentials of western Canadian coals as a source of good quality metallurgical coal was demonstrated to the extent that the producing mines increased their mine production and new mines opened. Coal became a major export commodity (e.g. 13×10^6 tons were exported in 1977 valued at approximately one-half billion dollars). This achievement was accomplished by operating largely at the pilot-plant level (i.e. the small 'd'). The big 'D' demonstrations were later carried out in Japan. As an adjunct to the CANMET's role in the development of the export market for coking coal, the

Canadian Carbonization Research Association (CCRA) was formed in 1965. This industry-government association has almost full representation of the integrated steel producers and coking coal producers in Canada. Regular meetings of a technical committee appointed by this Association are held to propose cost-shared projects for approval by the CANMET Energy Research Program. The current CCRA/CANMET project is aimed at determining to what extent indigenous coals could replace imported coals in the Canadian steel industry, (e.g. approximately 8×10^6 tons of coal valued at about one-half billion dollars per year are imported into Canada). The CCRA represents but a small fraction of the interests in the overall coal system. It is, however, an example of good industry-government relationship which could be projected to include other technologies in the field of coal utilization. Such associations can be woven into the CORDA concept. In fact, CORDA in many ways is a more formalized and expanded version of the CCRA concept.

CANMET has the expertise with regard to the pursuance of R & D in coal utilization, as well as in mining and beneficiation, which are basic to all aspects of the coal system. In this regard CANMET should maintain its central role. It is the fulfillment of the Canadian coal processing and associated R & D that is necessary. The engineering group of CORDA, referred to previously, is necessary to demonstrate whether those projects which indicated promising results in the laboratory and in the pilot plant can or cannot proceed to commercial development. The engineers of the group must be capable of managing commercial-scale projects and, at the same time, be cognizant of the applied aspect of the day-to-day difficulties of

operating a plant and making it a viable venture. It is realized that engineers of this calibre are currently in high demand by industry and may be difficult to recruit for CORDA. However, the challenge is there for those with the pioneering spirit of demonstration units. Young scientists seconded to CORDA would have the opportunity of obtaining practical training in their field while the senior engineer would have the reciprocal benefit of those with an advanced training in the fundamentals.

As CANMET should maintain a dominant role in the CORDA concept, an arrangement is envisaged whereby eventually a CANMET centre with specific facilities could be strategically located. The centre could be "wrapped around" CORDA, thus providing a permanent residence and good working environment for the new agency. The facilities could be made available for sharing by those contributing to solving energy problems on coal.

The centre could include CANMET facilities now located in Western Canada, some of which may require re-location in the near future; for example, the coal cleaning and carbonization facilities of the Western Research Laboratory now located in the Cloverbar establishment of the Alberta Research Council (Edmonton) and the Western Office of the Mining Research Laboratories (Calgary).

The Role of Industrial Intermediary Organizations

The effectiveness of one particular technical organization, namely the CCRA, has been cited above. This group, with its membership drawn from the Canadian steel and coal industries, should continue to perform its useful functions in planning and cost-sharing of those carbonization projects

approved by the Energy Research Program. In addition, the scope of responsibility of the CCRA Technical Committee should be expanded to act as a contributing advisory body to CORDA on coal carbonization. Its cross section of membership should be a source of practical advice in the preparation of projects and in the selection of demonstrations. Other groups such as FERA, CSIRA and task groups of NACMMR might act in a similar capacity.

The Role of Support Services

There is a strong need for adequate support services from the private sector in terms of routine analyses and tests. Much of this work is now being carried out by government laboratories, in many cases as a result of the unavailability of adequate facilities. Business in this field of endeavour appears to suffer the feast or famine cycles of the coal industry. The staff is usually depleted during softness in the coal trade with the difficulty of scaling-up and adequately training personnel to meet the demands for this type of service when required. Continuing coal projects at a coal centre in western Canada could provide a steady potential source of business for local commercial testing laboratories. Coal projects sponsored by an agency such as CORDA would allow the private sector to bid on support work for the project and provide a "flywheel effect" and smooth out the "hi's and lo's" presently suffered by this type of business. The scope of standard or well-recognized methods of testing provided by the private sector could possibly be expanded beyond the services which have been offered up to now. However, certain types of pilot-scale facilities often necessary in the development of research proposals (i.e. the small 'D' of R, D & D) are usually too costly or not

profitable for the private sector to undertake. Pilot-scale coke oven tests which are mandatory in the evaluation of coking coals are in this category. The Canadian steel and coal industries are served exclusively by CANMET concerning their requirements for technical-scale coke oven evaluations. In this particular case the Canadian Carbonization Research Association (CCRA) presently underwrites six unfunded man years. Cleaning of bulk coal samples on a routine basis may also be included in this category.

A Location for CORDA

The actual choice of a specific location for CORDA is a difficult decision. In the main, there are the following situations to consider in a selection of a location for the new agency:

1. CORDA (independent);
2. CORDA associated with CANMET facilities
   (a) coal community or urban area
   (b) Eastern Canada or Western Canada
   (c) specific location

1. If CORDA is limited to a process engineering group comprising a small number of project engineers with support administrative staff, then its actual location could be anywhere in Canada. Ottawa, for example, would probably suffice, as well as any other location, In all probability this would be the case for the new agency during its initial stages.

2. (a) As mentioned previously, ultimately it would be advantageous to associate with CANMET facilities. Under these conditions an integration of coal research with the coal community would appear to be a logical consideration whereby mutual benefits should occur. For example, there should be a stimulation to coal research by direct and continual close contact with the coal community and its problems. On a reciprocal basis the availability of technical personnel would provide good potentials for training in all aspects of the coal system. The location of a research group remote from major urban communities can be a deterrent as it usually lacks the amenities necessary to attract and maintain good technical personnel. However, a precedent has been set with the successful establishment of the mining research laboratory in Elliot Lake, Ontario in 1965. On this basis a location within coal community is recommended.

2. (b) Canadian coal sources are located in Eastern and Western Canada. Geography has dealt a further blow by placing the major domestic markets in Central Canada. With regard to Eastern Canada, considerable effort is now being put forward by the Bras D'Or Institute of the College of Cape Breton to establish a Coal Development Centre in Cape Breton, Nova Scotia. The proposed Centre will deal specifically with R & D of Eastern Canadian coals including most aspects of the coal system. In light of the broad scope of effort proposed for Eastern Canadian coals by the Coal Development Centre, it is therefore recommended that CORDA concentrate and locate itself in Western Canada and that the activities of the Coal Development

Centre of the Bras D'Or Institute be coordinated with the other national activities in coal through CORDA by representation on the Advisory Council of CORDA.

2. (c) In Western Canada, Sparwood, British Columbia is suggested as the choice location for CORDA and associated CANMET facilities. The community of Sparwood is located adjacent to the largest operating mine in Canada, namely Kaiser Resources Limited. Currently the mines located within a radius of forty miles of Sparwood produce in excess of 60 percent of the total production of Canadian bituminous coal, and new mines are proposed for this area (see Table 1 and Figure 1).

TABLE 1

Producing and Proposed Mines Within a 40-Mile Radius of Sparwood

Operator	Annual Output 10^6 tons	Seam Rank	Principal Market
Kaiser Resources Limited (operating)	8.5	mvb & lvb	coking coal
Fording Coal Ltd. (operating)	4.8	mvb	coking coal
Coleman Collieries Ltd. (operating)	1.3	mvb	coking coal
Byron Creek Collieries Ltd. (operating)	0.4	mvb (oxidized)	thermal power
Elco Mining Ltd. (proposed)	4.0	mvb	coking coal
Shell Canada Ltd. (proposed)	na	mvb	coking coal
Sage Creek Coal Ltd. (proposed)	3.0	mvb	coking coal

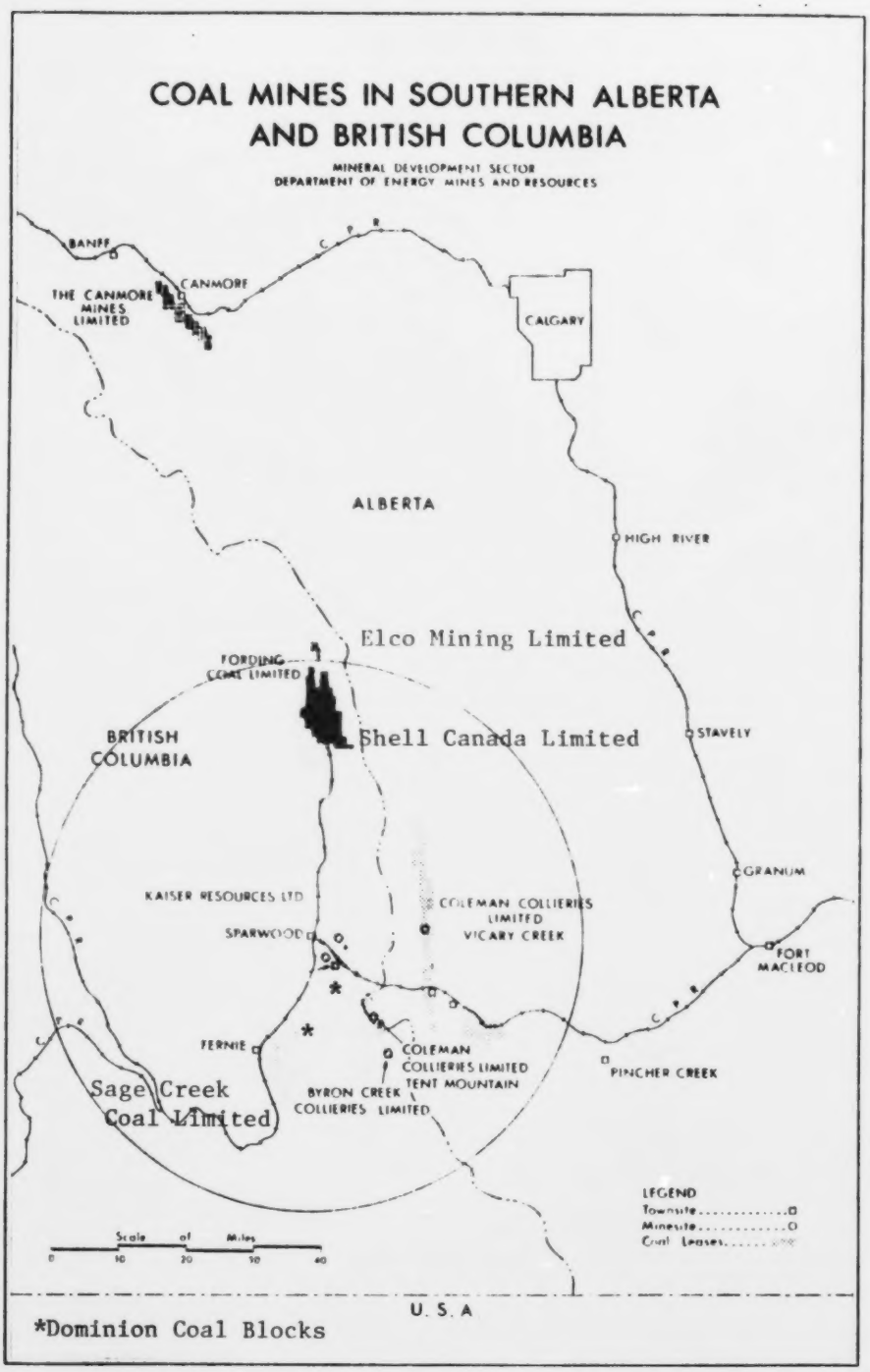


Figure 1. Locations of Producing and Proposed Coal Mines and Relevant Coal Blocks within a 40-Mile Radius of Sparwood, B.C.

Although coal from the operating mines and the proposed mines is principally medium volatile in rank and destined for the coking coal markets, all ranks of coal from low volatile bituminous to high volatile 'A' bituminous occur stratigraphically in the seam deposits of this area. The Dominion Coal Blocks are also located in this area. The coal reserves occur in two blocks of land (i.e. Parcel 73 consisting of 5,000 acres and Parcel 82 of 45,000 acres). On a geological basis the Blocks have been estimated to contain 8.6 billion tons of bituminous coal representing 10 percent of the assessed bituminous coal reserves in the mountain region. As Crown lands, the development of these reserves are, of course, of major concern to the federal government. The Crow's Nest Pass Act of 1897 clearly stipulates that the coal produced will be for Canadian use only. It is appropriate that CORDA be located in close proximity to the Dominion Blocks in anticipation of the many activities which will take place prior to the development of these coal reserves.

OBJECTIVES AND PROGRAM

The objective of CORDA is to provide advanced technology in the coal industry through Research, Development and Demonstration by:

1. bringing together the expertise, knowledge, experience, needs, views and capabilities of those in industry, governments and universities to:

(a) jointly plan and/or select research and development projects to effectively solve national energy problems in coal;

(b) co-ordinate research programs on coal to avoid a duplication and fragmentation of research efforts in Canada;

(c) advise on matters pertaining to the selection of research and development efforts which should advance to the demonstration stage.

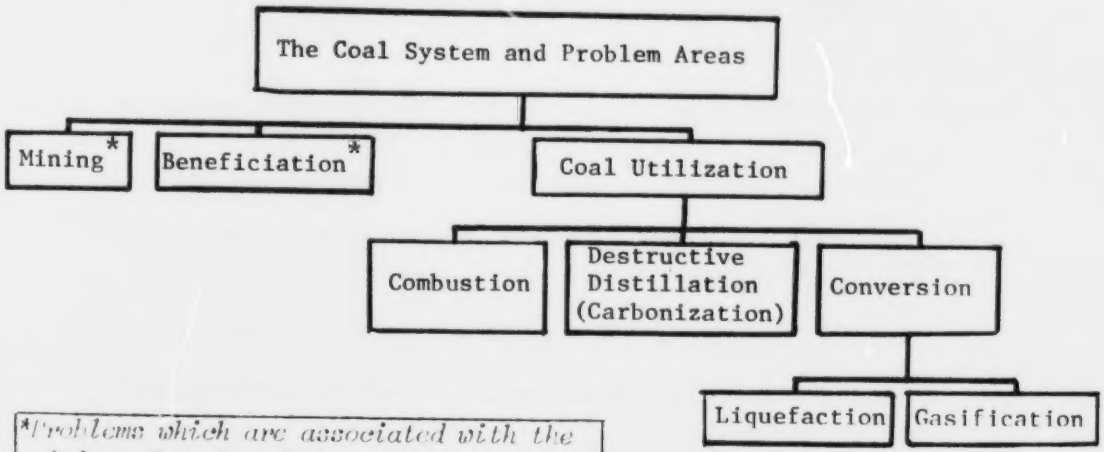
2. providing a process engineering group of mature, experienced engineers to act as project engineers for coal demonstrations.

The program will emanate and evolve as the national efforts on coal R, D & D are reviewed by the Board of Directors of CORDA. Projects expected to reach the demonstration stage within 3 years have been identified with priorities in a coal strategy paper prepared by the Coal Utilization Sub-Committee of the EMR Coal Committee (July 1978). Such demonstrations are available for immediate consideration.

ORGANIZATION

CORDA and the Coal System

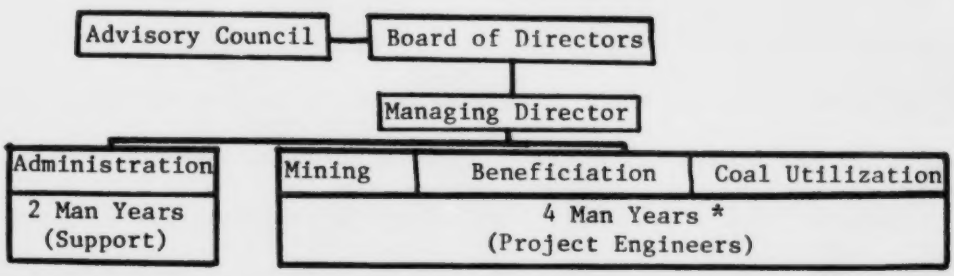
Problems requiring R, D & D in the coal system in general will occur in the blocked areas of the following diagram:



Problems which are associated with the mining of coal and the removal of extraneous material (beneficiation) have a direct bearing upon the subsequent processing of the coal. Environmental control is common to mining, beneficiation and utilization of coal and presents other problems to resolve in the overall coal system.

In order to effectively resolve the problems in the above areas of the coal system, the organization chart of the agency might initially look somewhat as follows:

ORGANIZATION CHART FOR CORDA



*Technical support seconded from CANMET, if required, in addition to above.

Board of Directors

The members of the Board should be selected so as to provide a well-balanced crossection of coal interests in the government-industry-university communities of Canada. CANMET should be represented on the Board by the Director-General of CANMET or his designated alternate. The following are suggested as the sources for the main Membership of CORDA:

- The Coal Association of Canada;
- Government departments, research councils, foundations and agencies concerned with coal interests;
- Universities with coal interests;
- Department of Energy, Mines and Resources.

The total membership on the Board of Directors should be less than 12 in number. The Executive of the Board would be elected by the Board Members on an annual basis. The Board and the Executive would provide the following function:

1. control planning of facilities, programs and budgets, and evaluation of output;
2. establish an Advisory Council to identify problem areas;
3. review reports from external groups and the Advisory Council.

The Advisory Council

The members should be judiciously selected from research groups, industry, agencies and universities with coal interests. The Canadian Carbonization Research Association (CCRA), which represents the integrated steel industry and producers of coking coal in Canada, could materially assist in advising the Council in those matters pertaining to carbonization.

FERA, CSIRA and task groups of NACMR could also supply similar assistance in other areas. Such associations should be encouraged, if not now available, to provide technical advice on mining, beneficiation, combustion and coal conversion. The proposed Coal Development Centre in Nova Scotia, if it becomes a reality, should also be a member of the Advisory Council.

The Managing Director

The Managing Director should be responsible for operations and contracts. He should be a member of the Board of Directors and provide the secretariat for the Board. He would chair the Advisory Council, serve on relevant committees, organize conferences, meetings, and maintain the liaison with industrial, academic and government research agencies.

Budget

A portion of CANMET contract money would be used to finance CORDA. It is envisaged that about 2 million dollars would be used to launch the agency during its first year. Shared costs of R, D & D may be provided as the CORDA concept evolved.

Control

The Board of Directors would be fully responsible for the planning and execution of programs, and the expenditure of funds. An annual performance evaluation report would be prepared, for submission to Treasury Board, by the EMR representatives on the Board of Directors. The Director General of CANMET would be responsible for forwarding this report to Treasury Board.